



## General

### Guideline Title

Practice guidelines for central venous access. A report by the American Society of Anesthesiologists Task Force on Central Venous Access.

### Bibliographic Source(s)

Practice guidelines for central venous access: a report by the American Society of Anesthesiologists Task Force on Central Venous Access. *Anesthesiology*. 2012 Mar;116(3):539-73. [132 references] [PubMed](#)

### Guideline Status

This is the current release of the guideline.

## Recommendations

### Major Recommendations

#### Resource Preparation

- Central venous catheterization should be performed in an environment that permits use of aseptic techniques.
- A standardized equipment set should be available for central venous access. (See Appendix 2 in the original guideline document for an example of a Standardized Equipment Cart for Central Venous Catheterization for Adult Patients.)
- A checklist or protocol should be used for placement and maintenance of central venous catheters. (See Appendix 3 of the original guideline document for an example of a Central Venous Catheterization Checklist.)
- An assistant should be used during placement of a central venous catheter.

#### Prevention of Infectious Complications

- For immunocompromised patients and high-risk neonates, administer intravenous antibiotic prophylaxis on a case-by-case basis.
  - Intravenous antibiotic prophylaxis should not be administered routinely.
- In preparation for the placement of central venous catheters, use aseptic techniques (e.g., hand washing) and maximal barrier precautions (e.g., sterile gowns, sterile gloves, caps, masks covering both mouth and nose, and full-body patient drapes).
- A chlorhexidine-containing solution should be used for skin preparation in adults, infants, and children.
  - For neonates, the use of a chlorhexidine-containing solution for skin preparation should be based on clinical judgment and institutional protocol.
  - If there is a contraindication to chlorhexidine, povidone-iodine or alcohol may be used as alternatives.
  - Unless contraindicated, skin preparation solutions should contain alcohol.
- Catheters coated with antibiotics or a combination of chlorhexidine and silver sulfadiazine should be used for selected patients based on

infectious risk, cost, and anticipated duration of catheter use.

- Catheters containing antimicrobial agents are not a substitute for additional infection precautions.
- Catheter insertion site selection should be based on clinical need.
  - An insertion site should be selected that is not contaminated or potentially contaminated (e.g., burned or infected skin, inguinal area, adjacent to tracheostomy or open surgical wound).
  - In adults, selection of an upper body insertion site should be considered to minimize the risk of infection.
- The use of sutures, staples, or tape for catheter fixation should be determined on a local or institutional basis.
- Transparent bio-occlusive dressings should be used to protect the site of central venous catheter insertion from infection.
  - Unless contraindicated, dressings containing chlorhexidine may be used in adults, infants, and children.
  - For neonates, the use of transparent or sponge dressings containing chlorhexidine should be based on clinical judgment and institutional protocol.
- The duration of catheterization should be based on clinical need.
  - The clinical need for keeping the catheter in place should be assessed daily.
  - Catheters should be removed promptly when no longer deemed clinically necessary.
- The catheter insertion site should be inspected daily for signs of infection.
  - The catheter should be changed or removed when catheter insertion site infection is suspected.
- When a catheter-related infection is suspected, replacing the catheter using a new insertion site is preferable to changing the catheter over a guidewire.
- Catheter access ports should be wiped with an appropriate antiseptic before each access when using an existing central venous catheter for injection or aspiration.
- Central venous catheter stopcocks or access ports should be capped when not in use.
- Needleless catheter access ports may be used on a case-by-case basis.

#### Prevention of Mechanical Trauma or Injury

- Catheter insertion site selection should be based on clinical need and practitioner judgment, experience, and skill.
  - In adults, selection of an upper body insertion site should be considered to minimize the risk of thrombotic complications.
- When clinically appropriate and feasible, central venous access in the neck or chest should be performed with the patient in the Trendelenburg position.
- Selection of catheter size (i.e., outside diameter) and type should be based on the clinical situation and skill/experience of the operator.
  - Selection of the smallest size catheter appropriate for the clinical situation should be considered.
- Selection of a thin-wall needle (a wire-through-thin-wall-needle, or Seldinger) technique versus a catheter-over-the-needle (a catheter-over-the-needle-then-wire-through-the-catheter, or Modified Seldinger) technique should be based on the clinical situation and the skill/experience of the operator.
  - The decision to use a thin-wall needle technique or a catheter-over-the-needle technique should be based at least in part on the method used to confirm that the wire resides in the vein before a dilator or large-bore catheter is threaded.
  - The catheter-over-the-needle technique may provide more stable venous access if manometry is used for venous confirmation.
- The number of insertion attempts should be based on clinical judgment.
- The decision to place two catheters in a single vein should be made on a case-by-case basis.
- Use static ultrasound imaging in elective situations before prepping and draping for prepuncture identification of anatomy to determine vessel localization and patency when the internal jugular vein is selected for cannulation.
  - Static ultrasound may be used when the subclavian or femoral vein is selected.
- Use real-time ultrasound guidance for vessel localization and venipuncture when the internal jugular vein is selected for cannulation.
  - Real-time ultrasound may be used when the subclavian or femoral vein is selected.
  - Real-time ultrasound may not be feasible in emergency circumstances or in the presence of other clinical constraints.
- After insertion of a catheter that went over the needle or a thin-wall needle, confirm venous access.\*
  - Methods for confirming that the catheter or thin-wall needle resides in the vein include, but are not limited to: ultrasound, manometry, pressure-waveform analysis, or venous blood gas measurement.
  - Blood color or absence of pulsatile flow should not be relied upon for confirming that the catheter or thin-wall needle resides in the vein.
- When using the thin-wall needle technique, confirm venous residence of the wire after the wire is threaded.
- When using the catheter-over-the-needle technique, confirmation that the wire resides in the vein may not be needed (1) when the catheter enters the vein easily and manometry or pressure waveform measurement provides unambiguous confirmation of venous location of the catheter, and (2) when the wire passes through the catheter and enters the vein without difficulty.
  - If there is any uncertainty that the catheter or wire resides in the vein, confirm venous residence of the wire after the wire is threaded.

Insertion of a dilator or large-bore catheter may then proceed.

- Methods for confirming that the wire resides in the vein include, but are not limited to surface ultrasound (identification of the wire in the vein) or transesophageal echocardiography (identification of the wire in the superior vena cava or right atrium), continuous electrocardiography (identification of narrow-complex ectopy), or fluoroscopy.
- After final catheterization and before use, confirm residence of the catheter in the venous system as soon as clinically appropriate.
  - Methods for confirming that the catheter is still in the venous system after catheterization and before use include waveform manometry or pressure measurement.
- Confirm the final position of the catheter tip as soon as clinically appropriate.
  - Methods for confirming the position of the catheter tip include chest radiography, fluoroscopy, or continuous electrocardiography.
- For central venous catheters placed in the operating room, perform the chest radiograph no later than the early postoperative period to confirm the position of the catheter tip.

\*For neonates, infants, and children, confirmation of venous placement may take place after the wire is threaded.

#### Management of Arterial Trauma or Injury Arising from Central Venous Catheterization

- When unintended cannulation of an arterial vessel with a dilator or large-bore catheter occurs, the dilator or catheter should be left in place and a general surgeon, a vascular surgeon, or an interventional radiologist should be immediately consulted regarding surgical or nonsurgical catheter removal for adults.
  - For neonates, infants, and children, the decision to leave the catheter in place and obtain consultation or to remove the catheter nonsurgically should be based on practitioner judgment and experience.
- After the injury has been evaluated and a treatment plan has been executed, the anesthesiologist and surgeon should confer regarding relative risks and benefits of proceeding with the elective surgery versus deferring surgery for a period of patient observation.

## Clinical Algorithm(s)

The original guideline document includes an algorithm for central venous insertion and verification.

## Scope

### Disease/Condition(s)

Elective central venous access procedures

### Guideline Category

Management

Prevention

### Clinical Specialty

Anesthesiology

Cardiology

Family Practice

Internal Medicine

Nursing

Pediatrics

Preventive Medicine

Radiology

Surgery

## Intended Users

Advanced Practice Nurses

Allied Health Personnel

Health Care Providers

Nurses

Patients

Physician Assistants

Physicians

## Guideline Objective(s)

- To provide guidance regarding placement and management of central venous catheters
- To reduce infectious, mechanical, thrombotic, and other adverse outcomes associated with central venous catheterization
- To improve management of arterial trauma or injury arising from central venous catheterization
- To provide updated recommendations on some issues and new recommendations on issues that have not been previously addressed by other guidelines

## Target Population

Patients undergoing elective central venous access procedures

Note: These Guidelines do not address patients requiring:

Assessment of clinical indications for placement of central venous catheters

Emergency placement of central venous catheters

Peripherally inserted central catheters

Placement and residence of a pulmonary artery catheter

Insertion of tunneled central lines (e.g., permacaths, portacaths, Hickman®, Quinton®)

Detection or treatment of infectious complications associated with central venous catheterization

Diagnosis and management of central venous catheter-associated trauma or injury (e.g., pneumothorax or air embolism), with the exception of carotid arterial injury

## Interventions and Practices Considered

### Management

1. Resource preparation for central venous catheterization (use of an environment permitting aseptic technique, standardized equipment set, placement and maintenance checklist, use of an assistant)
2. Consideration of upper body insertion site for adults
3. Prompt removal of unneeded catheters
4. Prompt removal of catheter if insertion site infection is suspected
5. Management of arterial trauma or injury
  - Consultation with a general surgeon, vascular surgeon, or interventional radiologist

- Development of a treatment plan (immediate removal versus observation, elective surgery versus observation)

## Prevention

### 1. Prevention of infectious complications

- Use of intravenous antibiotic prophylaxis in selected cases (not routinely recommended)
- Use of aseptic technique, including hand washing and maximal barrier precautions
- Aseptic skin preparation (chlorhexidine-containing solution, povidone-iodine solution, alcohol, use of an institutional protocol for neonates)
- Use of antibiotic-coated catheters
- Selection of an uncontaminated insertion site away from a potentially contaminated site
- Use of sutures, staples, or tape for catheter fixation on an institutional basis
- Use of transparent bio-occlusive dressings
- Daily assessment of continued need for catheterization and potential infectious complication
- New insertion of a catheter if insertion site infection is suspected
- Antiseptic wiping of access ports
- Capping of stopcocks or access ports when not in use
- Use of needleless port on a case-by-case basis

### 2. Prevention of mechanical trauma or injury

- Insertion site selection based on experience and skill of the practitioner
- Positioning of the patient during insertion (Trendelenburg position for neck or chest insertion)
- Selection of catheter size
- Selection of a thin-walled needle based on confirmation of placement method
- Number of insertion attempts
- Placement of two catheters in a single vein on a case-by-case basis
- Use of static ultrasound imaging for preparation
- Use of real-time ultrasound guidance for internal jugular vein cannulation, if feasible
- Confirmation of venous access
- Timing of confirmation of final catheter position

## Major Outcomes Considered

- Catheter-related infection, bacteremia, and sepsis rates
- Catheter tip colonization rates
- Injury and complication rates of catheter placement
- Success rate of venipuncture and catheterization
- Efficacy of interventions to reduce infection
- Effective identification of catheter position

## Methodology

### Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

State of the Literature

For these Guidelines, a literature review was used in combination with opinions obtained from expert consultants and other sources (e.g., American Society of Anesthesiologists members, Society for Pediatric Anesthesia members, open forums, Internet postings). Both the literature review and opinion data were based on evidence linkages, or statements regarding potential relationships between clinical interventions and outcomes. The interventions listed below were examined to assess their effect on a variety of outcomes related to central venous catheterization.

#### *Resource Preparation*

- Selection of a sterile environment
- Availability of a standardized equipment set
- Use of a checklist or protocol for placement and maintenance
- Use of an assistant for placement

#### *Prevention of Infectious Complications*

- Intravenous antibiotic prophylaxis
- Aseptic techniques
- Aseptic preparation
  - Hand washing, sterile full-body drapes, sterile gown, gloves, mask, cap
- Skin preparation
  - Chlorhexidine versus povidone-iodine
- Aseptic preparation with versus without alcohol
- Selection of catheter coatings or impregnation
  - Antibiotic-coated catheters versus no coating
  - Silver-impregnated catheters versus no coating
  - Chlorhexidine combined with silver sulfadiazine catheter coating versus no coating
- Selection of catheter insertion site
  - Internal jugular
  - Subclavian
  - Femoral
  - Selecting a potentially uncontaminated insertion site
- Catheter fixation
  - Suture, staple, or tape
- Insertion site dressings
  - Clear plastic, chlorhexidine, gauze and tape, cyanoacrylate, antimicrobial dressings, antibiotic ointment
- Catheter maintenance
  - Long-term versus short-term catheterization
  - Frequency of insertion site inspection for signs of infection
- Changing catheters
  - Specified time intervals
  - Specified time interval versus no specified time interval (i.e., as needed)
  - One specified time interval versus another specified time interval
  - Changing a catheter over a wire versus a new site
- Aseptic techniques using an existing central line for injection or aspiration
  - Wiping ports with alcohol
  - Capping stopcocks
  - Needleless connectors or access ports

#### *Prevention of Mechanical Trauma or Injury*

- Selection of catheter insertion site
  - Internal jugular
  - Subclavian
  - Femoral
- Trendelenburg versus supine position
- Needle insertion and catheter placement
- Selection of catheter type (e.g., double lumen, triple lumen, Cordis)

- Selection of a large-bore catheter
- Placement of two catheters in the same vein
- Use of a Seldinger technique versus a modified Seldinger technique
- Limiting number of insertion attempts
- Guidance of needle, wire, and catheter placement
  - Static ultrasound versus no ultrasound (i.e., anatomic landmarks)
  - Real-time ultrasound guidance versus no ultrasound
- Verification of placement
  - Manometry versus direct pressure measurement (via pressure transducer)
  - Continuous electrocardiogram
  - Fluoroscopy
  - Venous blood gas
  - Transesophageal echocardiography
  - Chest radiography

#### *Management of Trauma or Injury Arising from Central Venous Catheterization*

- Not removing versus removing central venous catheter on evidence of arterial puncture

For the literature review, potentially relevant clinical studies were identified via electronic and manual searches of the literature. The principal source of citations was PubMed, although citations from the Cochrane database, direct internet searches, task force members, liaisons from other organizations, and hand searches of references located in reviewed articles were also obtained. The electronic and manual searches covered a 44-year period from 1968 through 2011. More than 2,000 citations were initially identified, yielding a total of 671 nonoverlapping articles that addressed topics related to the evidence linkages. After review of the articles, 383 studies did not provide direct evidence, and were subsequently eliminated. A total of 288 articles contained direct linkage-related evidence. A complete bibliography used to develop these Guidelines, organized by section, is available as Supplemental Digital Content 2, <http://links.lww.com/ALN/A784> .

## Number of Source Documents

A total of 288 articles contained direct linkage-related evidence.

## Methods Used to Assess the Quality and Strength of the Evidence

Expert Consensus

Weighting According to a Rating Scheme (Scheme Given)

## Rating Scheme for the Strength of the Evidence

Preparation of these Guidelines followed a rigorous methodologic process. Evidence was obtained from two principal sources: scientific evidence and opinion-based evidence.

### Scientific Evidence

Study findings from published scientific literature were aggregated and are reported in summary form by evidence category, as described in the following paragraphs. All literature (e.g., randomized controlled trials, observational studies, case reports) relevant to each topic was considered when evaluating the findings. However, for reporting purposes in this document, only the highest level of evidence (i.e., level 1, 2, or 3 within category A, B, or C, as identified in the following paragraphs) is included in the summary.

Category A: Supportive Literature

Randomized controlled trials report statistically significant ( $P < 0.01$ ) differences between clinical interventions for a specified clinical outcome.

*Level 1:* The literature contains multiple randomized controlled trials, and aggregated findings are supported by meta-analysis.<sup>‡</sup>

*Level 2:* The literature contains multiple randomized controlled trials, but the number of studies is insufficient to conduct a viable meta-analysis for

the purpose of these Guidelines.

*Level 3:* The literature contains a single randomized controlled trial.

#### Category B: Suggestive Literature

Information from observational studies permits inference of beneficial or harmful relationships among clinical interventions and clinical outcomes.

*Level 1:* The literature contains observational comparisons (e.g., cohort, case-control research designs) of clinical interventions or conditions and indicates statistically significant differences between clinical interventions for a specified clinical outcome.

*Level 2:* The literature contains noncomparative observational studies with associative (e.g., relative risk, correlation) or descriptive statistics.

*Level 3:* The literature contains case reports.

#### Category C: Equivocal Literature

The literature cannot determine whether there are beneficial or harmful relationships among clinical interventions and clinical outcomes.

*Level 1:* Meta-analysis did not find significant differences ( $P > 0.01$ ) among groups or conditions.

*Level 2:* The number of studies is insufficient to conduct meta-analysis, and (1) randomized controlled trials have not found significant differences among groups or conditions or (2) randomized controlled trials report inconsistent findings.

*Level 3:* Observational studies report inconsistent findings or do not permit inference of beneficial or harmful relationships.

#### Category D: Insufficient Evidence from Literature

The lack of scientific evidence in the literature is described by the following terms:

*Inadequate:* The available literature cannot be used to assess relationships among clinical interventions and clinical outcomes. The literature either does not meet the criteria for content as defined in the "Focus" of the Guidelines or does not permit a clear interpretation of findings due to methodologic concerns (e.g., confounding in study design or implementation).

*Silent:* No identified studies address the specified relationships among interventions and outcomes.

#### Opinion-based Evidence

All opinion-based evidence relevant to each topic (e.g., survey data, open-forum testimony, Internet-based comments, letters, editorials) is considered in the development of these Guidelines. However, only the findings obtained from formal surveys are reported.

Opinion surveys were developed by the Task Force to address each clinical intervention identified in the document. Identical surveys were distributed to expert consultants and American Society of Anesthesiology (ASA) members, and a survey addressing selected pediatric issues was distributed to Society for Pediatric Anesthesia (SPA) members.

#### Category A: Expert Opinion

Survey responses from Task Force-appointed expert consultants are reported in summary form in the text, with a complete listing of consultant survey responses reported in appendix 5 of the original guideline document.

#### Category B: Membership Opinion

Survey responses from active ASA and SPA members are reported in summary form in the text, with a complete listing of ASA and SPA member survey responses reported in appendix 5 of the original guideline document.

Survey responses are recorded using a 5-point scale and summarized based on median values.<sup>§</sup>

*Strongly Agree.* Median score of 5 (at least 50% of the responses are 5).

*Agree.* Median score of 4 (at least 50% of the responses are 4 or 4 and 5).

*Equivocal.* Median score of 3 (at least 50% of the responses are 3, or no other response category or combination of similar categories contain at least 50% of the responses).

*Disagree.* Median score of 2 (at least 50% of responses are 2 or 1 and 2).

*Strongly Disagree.* Median score of 1 (at least 50% of responses are 1).

#### Category C: Informal Opinion

Open-forum testimony, Internet-based comments, letters, and editorials are all informally evaluated and discussed during the development of Guideline recommendations. When warranted, the Task Force may add educational information or cautionary notes based on this information.

<sup>‡</sup>All meta-analyses are conducted by the ASA methodology group. Meta-analyses from other sources are reviewed but not included as evidence in this document.

<sup>§</sup>When an equal number of categorically distinct responses are obtained, the median value is determined by calculating the arithmetic mean of the two middle values. Ties are calculated by a predetermined formula.

## Methods Used to Analyze the Evidence

### Meta-Analysis

#### Review of Published Meta-Analyses

#### Systematic Review

## Description of the Methods Used to Analyze the Evidence

### State of the Literature

Initially, each pertinent outcome reported in a study was classified as supporting an evidence linkage, refuting a linkage, or equivocal. The results were then summarized to obtain a directional assessment for each evidence linkage before conducting formal meta-analyses. Literature pertaining to five evidence linkages contained enough studies with well-defined experimental designs and statistical information sufficient for meta-analyses (see table 1 in the original guideline document). These linkages were (1) antimicrobial catheters, (2) silver sulfadiazine catheter coatings, (3) chlorhexidine and silver sulfadiazine catheter coatings, (4) changing a catheter over a wire versus a new site, and (5) ultrasound guidance for venipuncture.

General variance-based effect-size estimates or combined probability tests were obtained for continuous outcome measures, and Mantel-Haenszel odds-ratios were obtained for dichotomous outcome measures. Two combined probability tests were employed as follows: (1) the Fisher combined test, producing chi-square values based on logarithmic transformations of the reported probability (P) values from the independent studies, and (2) the Stouffer combined test, providing weighted representation of the studies by weighting each of the standard normal deviates by the size of the sample. An odds ratio procedure based on the Mantel-Haenszel method for combining study results using 2 x 2 tables was used with outcome frequency information. An acceptable significance level was set at  $P < 0.01$  (one-tailed). Tests for heterogeneity of the independent studies were conducted to assure consistency among the study results. DerSimonian-Laird random-effects odds ratios were obtained when significant heterogeneity was found ( $P < 0.01$ ). To control for potential publishing bias, a "fail-safe n" value was calculated. No search for unpublished studies was conducted, and no reliability tests for locating research results were done. To be accepted as significant findings, Mantel-Haenszel odds ratios must agree with combined test results whenever both types of data are assessed. In the absence of Mantel-Haenszel odds-ratios, findings from both the Fisher and weighted Stouffer combined tests must agree with each other to be acceptable as significant.

Interobserver agreement among Task Force members and two methodologists was established by interrater reliability testing. Agreement levels using a kappa ( $\kappa$ ) statistic for two-rater agreement pairs were as follows: (1) type of study design,  $\kappa = 0.70$ – $1.00$ ; (2) type of analysis,  $\kappa = 0.60$ – $0.84$ ; (3) evidence linkage assignment,  $\kappa = 0.91$ – $1.00$ ; and (4) literature inclusion for database,  $\kappa = 0.65$ – $1.00$ . Three-rater chance-corrected agreement values were (1) study design, Sav = 0.80, Var (Sav) = 0.006; (2) type of analysis, Sav = 0.70, Var (Sav) = 0.016; (3) linkage assignment, Sav = 0.94, Var (Sav) = 0.002; (4) literature database inclusion, Sav = 0.65, Var (Sav) = 0.034. These values represent moderate to high levels of agreement.

### Consensus-based Evidence

Consensus was obtained from multiple sources, including (1) survey opinion from consultants who were selected based on their knowledge or expertise in central venous access, (2) survey opinions solicited from active members of the American Society of Anesthesiologists (ASA) and

Society for Pediatric Anesthesia (SPA), (3) testimony from attendees of publicly-held open forums at two national anesthesia meetings, (4) Internet commentary, and (5) task force opinion and interpretation. The survey rate of return was 41.0% (n = 55 of 134) for the consultants (see table 2 in the original guideline document), 530 surveys were received from active ASA members (see table 3 in the original guideline document), and 251 surveys were received from active SPA members (see table 4 in the original guideline document).

An additional survey was sent to the expert consultants asking them to indicate which, if any, of the evidence linkages would change their clinical practices if the Guidelines were instituted. The rate of return was 16% (n = 22 of 134). The percentage of responding consultants expecting no change associated with each linkage were as follows: (1) availability of a standardized equipment set = 91.8%, (2) use of a trained assistant = 83.7%, (3) use of a checklist or protocol for placement and maintenance = 75.5%, (4) use of bundles that include a checklist or protocol = 87.8%, (5) intravenous antibiotic prophylaxis = 93.9%, (6) aseptic preparation (e.g., hand washing, caps, masks) = 98.0%, (8) skin preparation = 98.0%, (9) selection of catheters with antibiotic or antiseptic coatings/impregnation = 89.8%, (10) selection of catheter insertion site for prevention of infection = 100%, (11) catheter fixation methods = 89.8%, (12) insertion site dressings = 100%, (13) catheter maintenance = 100%, (14) aseptic techniques using an existing central line for injection or aspiration = 95.9%, (15) selection of catheter insertion site for prevention of mechanical trauma or injury = 100%, (16) Trendelenburg versus supine patient positioning for neck or chest venous access = 100%, (17) needle insertion and catheter placement = 100%, (18) guidance of needle, wire, and catheter placement = 89.8%, (19) verification of needle puncture and placement = 98.0%, (20) management of trauma or injury = 100%.

Fifty-seven percent of the respondents indicated that the Guidelines would have no effect on the amount of time spent on a typical case, and 43% indicated that there would be an increase of the amount of time spent on a typical case with the implementation of these Guidelines. Seventy-four percent indicated that new equipment, supplies, or training would not be needed to implement the Guidelines, and 78% indicated that implementation of the Guidelines would not require changes in practice that would affect costs.

#### Combined Sources of Evidence

Evidence for these Guidelines was formally collected from multiple sources, including randomized controlled trials, observational literature, surveys of expert consultants, and randomly selected samples of ASA and SPA members. This information is summarized in table 5 in the original guideline document, with a brief description of each corresponding recommendation.

## Methods Used to Formulate the Recommendations

#### Expert Consensus

### Description of Methods Used to Formulate the Recommendations

The American Society of Anesthesiologists (ASA) appointed a Task Force of 12 members, including anesthesiologists in both private and academic practice from various geographic areas of the United States and two consulting methodologists from the ASA Committee on Standards and Practice Parameters.

The Task Force developed the Guidelines by means of a seven-step process. First, they reached consensus on the criteria for evidence. Second, original published research studies from peer-reviewed journals relevant to central venous access were reviewed and evaluated. Third, expert consultants were asked to (1) participate in opinion surveys on the effectiveness of various central venous access recommendations and (2) review and comment on a draft of the Guidelines. Fourth, opinions about the Guideline recommendations were solicited from a sample of active members of the ASA. Opinions on selected topics related to pediatric patients were solicited from a sample of active members of the Society for Pediatric Anesthesia. Fifth, the Task Force held open forums at three major national meetings\* to solicit input on its draft recommendations. Sixth, the consultants were surveyed to assess their opinions on the feasibility of implementing the Guidelines. Seventh, all available information was used to build consensus within the Task Force to finalize the Guidelines.

\*Society for Pediatric Anesthesia Winter Meeting, April 17, 2010, San Antonio, Texas; Society of Cardiovascular Anesthesia 32nd Annual Meeting, April 25, 2010, New Orleans, Louisiana, and International Anesthesia Research Society Annual Meeting, May 22, 2011, Vancouver, British Columbia, Canada.

### Rating Scheme for the Strength of the Recommendations

Not applicable

## Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

## Method of Guideline Validation

External Peer Review

Internal Peer Review

## Description of Method of Guideline Validation

Expert consultants were asked to (1) participate in opinion surveys on the effectiveness of various central venous access recommendations and (2) review and comment on a draft of the Guidelines. Opinions about the Guideline recommendations were solicited from a sample of active members of the American Society of Anesthesiologists (ASA). Opinions on selected topics related to pediatric patients were solicited from a sample of active members of the Society for Pediatric Anesthesia (SPA).

The Task Force held open forums at three major national meetings to solicit input on its draft recommendations. The consultants were surveyed to assess their opinions on the feasibility of implementing the Guidelines. All available information was used to build consensus within the Task Force to finalize the Guidelines.

The Guidelines were approved by the ASA House of Delegates on October 19, 2011.

## Evidence Supporting the Recommendations

### Type of Evidence Supporting the Recommendations

Evidence was obtained from two principal sources: scientific evidence and opinion-based evidence.

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

- Optimal placement and management of central venous catheters in patients undergoing elective procedures
- Reduction in infectious, mechanical, thrombotic, and other adverse outcomes associated with central venous catheterization
- Optimal management of arterial trauma or injury arising from central venous catheterization

### Potential Harms

- Catheter colonization and catheter-related infections, including bacteremia
- A randomized controlled trial reports severe localized contact dermatitis when neonates receive chlorhexidine-impregnated dressings compared with povidone-iodine impregnated dressings.
- Mechanical trauma or injury, including thrombotic complications, arterial puncture, deep venous thrombosis, hematoma formation, pneumothorax, hemothorax, and arrhythmia
- Case reports describe severe injury (e.g., hemorrhage, hematoma, pseudoaneurysm, arteriovenous fistula, arterial dissection, neurologic injury including stroke, and severe or lethal airway obstruction) when there is unintentional arterial cannulation with large bore catheters.
- One nonrandomized comparative study reports a higher frequency of dysrhythmia when two central venous catheters are placed in the same vein (right internal jugular) compared with placement of one catheter in the vein.

# Qualifying Statements

## Qualifying Statements

- Practice Guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints, and are not intended to replace local institutional policies.
- Practice Guidelines developed by the American Society of Anesthesiologists are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

### Implementation Tools

Chart Documentation/Checklists/Forms

Clinical Algorithm

Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

### IOM Care Need

Getting Better

Staying Healthy

### IOM Domain

Effectiveness

Safety

## Identifying Information and Availability

### Bibliographic Source(s)

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## Adaptation

Not applicable: The guideline was not adapted from another source.

## Date Released

2012 Mar

## Guideline Developer(s)

American Society of Anesthesiologists - Medical Specialty Society

## Source(s) of Funding

American Society of Anesthesiologists

## Guideline Committee

American Society of Anesthesiologists Task Force on Central Venous Access

## Composition of Group That Authored the Guideline

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## Financial Disclosures/Conflicts of Interest

Not stated

## Guideline Endorser(s)

Society for Pediatric Anesthesia - Medical Specialty Society

Society of Cardiovascular Anesthesiologists - Medical Specialty Society

Society of Critical Care Anesthesiologists - Medical Specialty Society

## Guideline Status

This is the current release of the guideline.

## Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) and EPUB for eBook devices from the [Anesthesiology Journal Web site](#)

## Availability of Companion Documents

An example of a standardized equipment cart for central venous access catheterization for adult patients and an example of a central venous catheterization checklist are provided in the appendices to the [original guideline document](#) .

## Patient Resources

None available

## NGC Status

This NGC summary was completed by ECRI Institute on April 20, 2012. This summary was updated by ECRI Institute on March 6, 2014 following the U.S. Food and Drug Administration advisory on Over-the-Counter Topical Antiseptic Products.

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